Statement by CDFA Primary State Entomologist Kevin Hoffman regarding the Harder/Rosendale paper, "Integrated Pest Management Practices for the Light Brown Apple Moth in New Zealand: Implications for California"

I have performed a thorough review of the document "Integrated Pest Management Practices for the Light Brown Apple Moth in New Zealand: Implications for California" (Harder, Rosendale) and my comments, corrections and observations are listed in detail below, citing relevant sources where applicable.

In addition, Dr. Max Suckling, Science Leader, Biosecurity/Programme Leader, Insecticide Risk Reduction in New Zealand Horticulture for the federal agency HortResearch, and member of the Technical Working Group advising CDFA and USDA on the ongoing Light Brown Apple Moth (LBAM) Eradication Program in California, has expressed to me his dissatisfaction with the paper as it relates to comments attributed to his agency's employees:

> **"The report did not incorporate editorial changes suggested by HortResearch personnel, and chose to instead draw erroneous conclusions that can and should be challenged. In conclusion, my colleagues and I would like to distance HortResearch from this report. The report's authors solicited HortResearch to provide corrections, which were offered in a timely manner but unfortunately were not incorporated."**

Dr. Suckling has been researching the light brown apple moth for more than 20 years and has authored numerous studies on the pest.

General comments

The paper makes an overarching assertion that LBAM is currently kept largely under control by integrated pest management (IPM) practices and natural enemies in New Zealand. This view oversimplifies the case, and the authors omit key points regarding the introduction of non-native natural enemies. Certainly, IPM programs are more prevalent than in years past and are rightly credited with reducing the pest pressure on targeted crops and ecosystems. However, there are financial and environmental costs associated with implementing those practices, and these are not addressed in the report. The introduction of non-native natural enemies has its pitfalls. First, establishment often does not occur because the organism cannot adapt to the different environmental conditions that it finds itself exposed to. Second, generalist non-native natural enemies, like those imported into New Zealand for LBAM many years ago, are now of concern to ecologists because of their unanticipated negative impacts on native organisms. Consequently, the process to test and get approval for the importation of these non-natives has become much more stringent in recent years, and it is questionable whether the natural enemies of LBAM imported into New Zealand would ever be allowed to be imported and released in the U.S.

Also, the report focuses on applying the New Zealand model to the currently infested area of California, and ignores what might happen should the moth become established in different environments where the required IPM practices might be less effective, such as other parts of California, other states, and concerned trading partners such as Canada and Mexico. The authors display a lack of understanding about the purpose of classifying LBAM as a regulated pest and the necessity of implementing actions to restrict its movement.

The authors' citing of personal communications as if they are peer-reviewed publications (e.g., Shaw 2008) is inappropriate. These should be clearly indicated as personal communications whenever cited. The authors rely on these personal communications as sources of information instead of citing publications, which makes it impossible to critically review the information.

Specific Comments

Page 3, Table 1. The month comparisons are incorrect. For example, California's January should be compared with New Zealand's July, not June.

Page 4, paragraph 4. LBAM has four life stages not three. The egg stage was omitted.

Page 4, paragraph 5. LBAM females typically live 2-3 weeks in the field (Venette et al. 2003), which is twice as long as the 1–1.5 weeks indicated. The impression is given that the three matings result in three egg masses, which is not true. LBAM females lay an average of 300 eggs (6-10 egg masses at 30-50 eggs each), and have been known to lay up to 1492 eggs (30-50 egg masses at 30-50 eggs each), so the report significantly understates the moth's fecundity.

Page 4, paragraph 6. The statement "Any larva that falls or loses contact with its food source/host plant have little chance of survival, so the larvae stay connected to the plant by the silken thread." makes little sense. The whole point of ballooning is that the silk acts like a parachute that moves the larva through the air; the silk does not stay connected to the original plant. LBAM has a very wide host range, so it is likely to find a suitable host most places that it lands.

Page 4, paragraph 6. What is the source of the statement "Adults move the greatest distances (for dispersal of the populations)."? Ballooning larvae of gypsy moth, for instance, can move up to a mile or more.

Page 4, paragraph 6. The statement "LBAM does not form a central colony that can spread and cause detrimental effects in an agricultural field." is misleading. Colony formation is not a prerequisite for lepidopteran pests; in fact, no lepidopteran agricultural pests form colonies. They, like LBAM, can become pests because they build up numbers based on their fecundity and the availability of suitable hosts.

Page 4, paragraph 6. The statement "Because it is polyphagous, LBAM can disperse and survive without concentrating and adversely affecting all plants in a concentrated area." is misleading. Polyphagy helps overcome host availability as a limiting factor, and therefore helps populations grow. Also, in monoculture agriculture the only host is the crop, so there is no dilution of the population onto other plants.

Page 5, Figure 2. The photo doesn't show a leaf roll, which should be present for a larva of this size. Therefore, it is questionable whether this is LBAM or not. The "superficial leaf damage" doesn't look like caterpillar feeding damage at all. It certainly wasn't caused by a larva of this size; it would have fed along the edge of the leaf. I can only conclude that there is a real possibility that this photo was staged and does not represent an actual field situation.

Page 5, paragraphs 1 and 2. These are duplicates of paragraphs 5 and 6 on page 4.

Page 6, paragraph 3. Neither of the authors are entomologists, so their assertion that they had great difficulty finding LBAM could just as easily be from their lack of expertise at finding caterpillars as from the assumed lack of LBAM.

Page 6, paragraph 4. How can the authors be sure that the two parasitized larvae reported from UC Santa Cruz were LBAM? They would not have emerged as adults, and larvae require DNA analysis to distinguish them from other tortricids. Also, eight larvae is a very small sample size to be drawing definitive conclusions from.

Page 10, paragraph 2. The statement "New Zealand researchers also note that aerial pheromone spraying interferes with monitoring using pheromone traps, and monitoring is critical to successful control." is true, but it doesn't address eradication treatments. Monitoring is critical to control, but not to eradication during the treatment period. In fact, trap shutdown is an indirect indication that the pheromone disruption treatment is working.

Page 10, paragraph 2. The statement "Moreover, use of broadcast pheromone spray to eradicate or control the moth is not effective because female moths issue a more concentrated scent plume than the dispersed pheromone scent of an aerial spray application, so male moths are able to find the females (Shaw 2008)." implies that no mating disruption treatment can be effective, which is not true. The concept of mating disruption relies on the pheromone being dispersed throughout the target area. The amount of broadcast pheromone spray can be adjusted so as to give an effective concentration.

Page 10, paragraph 3. The statement "Pheromones have never been used for widespread eradication anywhere in the world." isn't accurate. USDA uses aerial application of gypsy moth pheromone to eradicate populations along the 1200 mile leading edge of the infested area in the eastern U.S. as part of their Slow The Spread campaign.

Page 10, paragraph 4. The authors seem to be advocating the areawide (i.e., aerial) use of IGRs for LBAM eradication. Insect Growth Regulators (IGRs) are the insect hormones or their synthetic mimics that govern an insect's maturation process. They disrupt the normal activity of the endocrine or hormone system of insects, affecting development, reproduction, or metamorphosis of the target insect. They have a much slower mode of action than synthetic chemical insecticides. IGRs include juvenile hormone mimics and chitin synthesis inhibitors. IGRs are broad spectrum and affect many different kinds of insects. They are also highly toxic to aquatic invertebrates. They have re-entry periods of 4-12 hours, and 7-14 day waiting periods before harvest for food crops. None of them are registered organic. In contrast, *Bacillus thuringiensis kurstaki* (Btk), is specific for Lepidoptera larvae, has a re-entry period of 4 hours, has no waiting period before crop harvest, and has organic formulations. Mating disruption products are even more specific (the pheromones usually affect only one species), have no re-

entry or harvest waiting periods, and have organic formulations. IGRs are clearly inferior to both Btk and mating disruption treatments in terms of target specificity, re-entry and harvest periods, and suitability for organic production.

Page 11, paragraph 2. There are over 300 tortricid species in California (California Moth Specimen Database). The UC IPM website categorizes LBAM as an exotic and invasive pest that threatens California's agricultural, urban or natural areas. Eight other tortricids in California that are listed as pests on UC IPM website and have insecticides as one of the recommended treatments: Amorbia (western avocado leafroller), apple pandemis, codling moth, fruit tree roller, garden tortrix, oblique-banded leafroller, omnivorous leafroller, and orange tortrix.

Page 11, paragraph 4. Chlorpyrifos is one of the recommendations for nurseries because it quickly kills any larvae and prevents eggs from hatching, thereby preventing the transport of viable life stages if the plants are to be moved within 24 hours of treatment. IGR's do not have these same properties, so IGR treated plants can harbor viable life stages that can then be spread to uninfested areas.

Page 12, paragraph 2. The issue isn't just with LBAM becoming established along the central coast, it also involves its potential establishment in other parts of California, in other states, and in other countries such as Canada and Mexico. What works in terms of LBAM control for some California cropping systems may not work in other places, so to deregulate would be irresponsible and would lead to the entire state of California being under quarantine for domestic shipments and to the possibility of the entire continental U.S. being under quarantine for international shipments to countries such as Canada and Mexico.

Page 13, paragraph 2. The word "product" in the following statement doesn't make sense, it appears that it should be "protect": "Eliminate requirements for organophosphate controls for LBAM in the U.S to product natural predator species that feed on LBAM and other pests."

Page 14. Figure 2 is a duplicate of Figure 2 from page 5.

Literature Cited

Venette, R. C., E. E. Davis, M. DaCosta, H. Heisler, and M. Larson. 2003. Mini Risk Assessment. Light brown apple moth, *Epiphyas postvittana* (Walker) [Lepidoptera: Tortricidae]. USDA CAPS PRA. 38 pp.